



Original article

Nutritional status of visceral leishmaniasis patients: A comparative cross-sectional study



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SUMMARY

Background: The objectives of this study were to estimate the prevalence and identify the determinants of nutritional status in Leishmaniasis patients and their family members.

Methods: A comparative cross-sectional study design was implemented among patients visiting the Kala-azar treatments centers in Amhara region. Systematic sampling technique was used to select the Kala-azar patients and simple random sampling technique was used to select the family members. Data were collected using interview, measuring anthropometric indicators and collecting the stool and blood samples. Descriptive statistics were used to estimate the proportion of malnutrition among the Kala-azar patients and their family members. Binary logistic regression was used to identify the determinants of malnutrition. 762 visceral leishmaniasis patients and 2287 family members were included.

Results: The prevalence of underweight among visceral leishmaniasis patients was 82% [95% CI: 79%–85%], the prevalence of underweight among visceral leishmaniasis family members was 48.3% [95% CI: 46%–50%]. The mean hemoglobin concentration of visceral leishmaniasis patients was 9.46 g/dl and the mean hemoglobin concentration of visceral leishmaniasis patients' family members was 11.46 g/dl. The nutritional status of kala-azar patients was affected by intestinal parasite (AOR: 15.65 [95% CI: 7.79–31.44]), male sex (AOR: 2.15 [95%CI: 1.12–4.12]), literacy (AOR: 0.4 [AOR: 0.2–0.84]), urban residence (AOR: 0.46 [95%; 0.23–0.92]), income (AOR: 3.44 [95% CI: 1.76–6.74]).

Conclusion: The visceral leishmaniasis treatments guideline should consider supplying nutrients including iron as part of the curative intervention.

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1. Introduction

Malnutrition is an imbalance between the supply of nutrients and the body demands. Underweight is an acute type of malnutrition and diagnosed if the BMI (Body mass index) falls below 18.5 [1]. Visceral leishmaniasis is a disease condition resulting from a vector called phlebotomine sand flies and prevalent in the lowland areas [2]. Globally more than 1.5million new cases of visceral Leishmaniasis was documented annually and if left untreated, the case fatality is 100% [3,4].

More than 90% of visceral Leishmaniasis cases were concentrated in 6 countries Bangladesh, India, Nepal, Sudan, Ethiopia and Brazil [5–8]. Ethiopia bears the second highest burden in terms of visceral Leishmaniasis patients in sub-Saharan Africa, more than 5000 new cases of visceral Leishmaniasis case was reported

annually [9,10]. Visceral Leishmaniasis epidemics spread in more than 40 localities such as Methema, Humera, Wolkaite Shiraro, Libokemkem, Segen valley and its surrounding in the Southwest, and the lower Omo plains [9,11].

The relationship between malnutrition and Leishmaniasis is vice versa: malnutrition increases the risk and severity of visceral Leishmaniasis; visceral Leishmaniasis increases the risk of malnutrition [12–14]. The nutritional status of Kala-azar patients have a critical role in the outcome of the disease, good nutritional status favors the outcomes of kala-azar treatments [15–17].

The nutritional intervention part of Leishmaniasis treatment was neglected. The critical role of nutritional intervention in the leishmaniasis treatment was neglected as a result of scarce evidence especially in the resource-constrained setting like Ethiopia. So, this research work give evidence on the nutritional status of kala-azar patients which makes the decision maker prioritize the nutritional intervention [18].

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In Amhara regional state, there are five Leishmaniasis treatment centers namely Abderafi health center, Metema hospital, Gondar University hospital, Addis Zemen health center and Felegehiwote referral hospital [19].

The objectives of this research work were to estimate and compare the nutritional status of leishmaniasis patients with their family members.

2. Methods

A comparative cross-sectional study design was implemented. The study was conducted among patients visiting the Kala-azar treatment centers of Amhara regional state. The sample size was calculated using Epi-info software with the assumption of 95% CI, 90% power, 50% proportion of malnutrition among Kala-azar patients, the odds ratio of 1.5, design effect of 2. The estimated sample size was 779 Kala-azar patients and 2370 household members. Systematic sampling techniques were used to select the Kala-azar patients. Simple random sampling technique was used to select the 3 family members. The data were collected from August 2016–July 2018. The data were collected using interview, measuring anthropometric indicators and collecting the stool and blood samples. The interview was conducted by 19 nurses and supervised by 8 health officers. Anthropometric measurements were collected by 3 clinical nurses. The blood and stool samples were collected by 6 laboratory technologist.

From each study participants, one gram stool sample was collected in 10 ml SAF (sodium acetate-acetic acid-formalin solution). A concentration technique was used. The stool samples were well mixed and filtered using a funnel with gauze then centrifuged for one minute at 2000 RPM (revolution per minute) and the supernatant was discarded. 7 ML (Milliliter) normal saline was added, mixed with a wooden stick, 3 ML ether was added and mixed well then centrifuged for 5 min at 2000 RPM. Finally, the supernatant was discarded and the whole sediment was examined for parasite [20]. 5 ML blood sample was collected from study participants following standard operating procedures to measure the hemoglobin concentration and the red cell indices of study participants using Mindray hematology analyzer.

To maintain the quality of the data pretest was conducted and the necessary amendment was done on the data collection tools, training were given for data collectors and supervisors. The collected data were checked for its completeness. Epi-info software was used for data entry. SPSS software was used for analysis. Descriptive statistics were used to estimate the proportion of underweight. Binary logistic regression was used to identify the determinants of malnutrition. Two sample t-tests were used to see the effect of kala-azra on the hemoglobin concentration of patients.

Ethical clearance was obtained from the University of Bahir Dar ethical review committee. Formal permission was obtained from the Amhara National Regional State Health Bureau ethical committee and the respective health institutions. Written informed consent was obtained from each study participants. The confidentiality of the data was kept at all steps. Study participants the right to withdraw from the study at any points were respected. Study participants with intestinal parasites or low hemoglobin concentration were advised to receive the intervention.

3. Results

A total of 3049 (762 visceral leishmaniasis patients and 2287 family members) were included giving for the response rate of 96.82%. The mean age of the study participants was 29.38 years; the youngest age of the study participants was 18 years. Around 55% of the study participants were infected by the intestinal parasite, the

predominant type of intestinal parasites was hookworm (17.4%) followed by Ascaris lumbricoid infection 13.2% (Table 1).

The prevalence of underweight among visceral leishmaniasis patients was 82% [95% CI: 79%–85%], the prevalence of underweight among visceral leishmaniasis family members was 48.3% [95% CI: 46%–50%]. This result was statistically significant at a p-value less than 0.01.

After adjusting for age, sex, family size, residence, marital status, income, occupation, educational status, intestinal parasitic infection: the nutritional status of visceral leishmaniasis patients was affected by Intestinal parasites, sex, educational status, occupation, residence, and income. The odds of malnutrition were 16 times higher among intestinal parasite infected kala-azar patients. Underweight was 2 times higher in male visceral leishmaniasis patients. The odds of malnutrition were 60% lower among literate visceral leishmaniasis patients. The odds of malnutrition were 54% lower among urban visceral leishmaniasis patients. The odds of malnutrition were 3 times higher among visceral leishmaniasis patients whose monthly income was less than 2000 birr (Table 2).

The mean hemoglobin concentration of visceral leishmaniasis patients was 9.46 g/dl and the mean hemoglobin concentration of visceral leishmaniasis patients' family members was 11.46 g/dl. It is found that 75% of visceral leishmaniasis patient have a hemoglobin concentration of less than 10 g/dl but more than 75% of visceral leishmaniasis family members had a hemoglobin concentration of greater than 12 g/dl. Iron deficiency anemia is the leading type of anemia constituting 85.7% of visceral leishmaniasis patients (Tables 3 and 4).

4. Discussion

The prevalence of underweight among visceral leishmaniasis patients was 82% [95% CI: 79%–85%], the prevalence of underweight among visceral leishmaniasis family members was 48.3% [95% CI: 46%–50%]. On multivariate logistic regression, it is found that the odds of underweight for visceral leishmaniasis patients were 4 folds higher than their family members (AOR: 3.94 [95% CI: 3.11–5]). This finding agrees with finding from northwest Ethiopia

Table 1
Population profile of the study participants (n = 3049).

SN ^a	Population profile	Frequency	Percentage	
1	Sex	Male	1955	64.1
		Female	1094	35.9
2	Residence	Urban	567	18.9
		Rural	2473	81.9
3	Marital status	Single	1290	42.3
		Married	1621	53.2
		Divorced	125	4.1
4	Income in Birr	<2000	13	0.4
		≥2000	664	21.8
5	Family size	<4	2385	78.2
		>4	1044	34.2
6	Intestinal parasites	≤4	2005	65.8
		>4	2005	65.8
		Not infected	1372	45
		Hookworm	530	17.4
		Ascaris lumbricoid	401	13.2
		Strongloid stercolaris	82	2.7
		Tricuris tricuris	54	1.8
		Ameba	39	1.3
7	Educational status	Balantidium coli	36	1.2
		H.nana	176	5.8
		Mixed infection	320	10.5
		Illiterate	1016	33.3
8	Type of study participants	Literate	2033	66.7
		Kala-azar patients	762	25
		Family members	2287	75

^a SN = serial number.

Table 2
Determinants of malnutrition/underweight among visceral leishmaniasis patients (n = 762).

Variables		Underweight		COR [95% CI]	AOR [95% CI]	P-value
		Present	Absent			
Intestinal parasite	Present	580	72	11.64 [7.23–18.77]	15.65 [7.79–31.44]	<0.01
	Absent	45	65			
Sex	Male	330	28	4.35 [2.74–6.69]	2.15 [1.12–4.12]	0.02
	Female	295	109			
Educational status	Literate	498	82	2.63 [1.74–3.97]	0.4 [0.2–0.84]	0.01
	Illiterate	127	55			
Occupation	Farmers	154	35	0.95 [0.61–1.49]	0.55 [0.3–0.99]	0.048
	Others	471	102			
Residence	Urban	166	60	0.46 [0.31–0.69]	0.46 [0.23–0.92]	0.03
	Rural	459	77			
Income	<2000	246	12	6.76 [3.55–13.15]	3.44 [1.76–6.74]	<0.01
	≥2000	379	125			

Table 3
Comparing the hemoglobin concentration for visceral leishmaniasis patients and their family members using independent sample t-test (n = 3049).

Independent Samples Test							
Hemoglobin concentration	t-test for Equality of Means			Mean Difference in g/dl	Std. Error Difference	95% Confidence Interval of the Difference	
	t	df ^a	P-value			Lower	Upper
	45.59	3047	<0.01	1.99	0.04	1.91	2.08

^a Df = degree of freedom.

Table 4
The morphology of red blood cells across visceral leishmaniasis patients and their family members (n = 3049).

MCV * MCHC Cross tabulation		MCHC ^a			Total
		Normochromic	Hypochromic	Hyperchromic	
Family members					
MCV ^d	Normocytic	1821	4	4	1829
	Microcytic	6	425	5	436
	Macrocytic	2	2	18	22
Total		1829	431	27	2287
VL ^b patients					
MCV ^c	Normocytic	43	0	4	47
	Microcytic	19	653	19	691
	Macrocytic	4	4	16	24
Total		66	657	39	762

^a MCHC = mean corpuscular hemoglobin concentration.

^b VL = visceral leishmaniasis.

^c MCV = mean corpuscular volume.

^d The significance of presenting these results was to identify the type/cause of anemia (low hemoglobin concentration).

[21]. This is because visceral leishmaniasis patients manifest with loss of appetite and disturbed gastrointestinal tract function which finally leads them to underweight [22].

The odds of malnutrition were 16 times higher among intestinal parasite infected kala-azar patients (AOR: 15.65 [95% CI; 7.79–31.44]). This finding agrees with finding from Gondar Ethiopia [23]. This is due to the reasons that intestinal parasites decrease the food intake of the patients, interferes with nutrient absorption, increases the metabolic requirement of the host and ingests the host nutrition leading to malnutrition [24].

Underweight was 2 times higher in male (AOR: 2.15 [95%CI; 1.12–4.12]). This finding agrees with finding from Sao Paulo [25]. This is because of the unfavorable lifestyles of males like alcohol abuse, cigarette smoking and substance abuse [26].

The odds of malnutrition were 60% lower among literate visceral leishmaniasis patients (AOR: 0.4 [AOR; 0.2–0.84]). This finding was in line with world surveillance report [27]. This is because literacy

leaves the life of individual out of poverty so that they can have an access to take variety of nutrients [28].

The odds of malnutrition were 54% lower among urban visceral leishmaniasis patients (AOR: 0.46 [95%; 0.23–0.92]). This finding agrees with a study conducted in a similar setting [29]. This is because people in urban areas are more educated and aware of their health [30,31].

The odds of malnutrition were 3 times higher among visceral leishmaniasis patients whose monthly income was less than 2000 birr (AOR: 3.44 [95% CI; 1.76–6.74]). This finding agrees with finding from Nigeria [32]. This is because of the affordability and accessibility of food to high-income families.

The mean hemoglobin concentration of visceral leishmaniasis patients was less than by 2 g/dl from their family members. Almost all visceral leishmaniasis patients were anemic; the leading type of anemia was iron deficiency anemia. This is because of the effect of visceral leishmaniasis on the red blood cell formation processes

especially the bone marrow and spleen functions. Additionally patient with visceral leishmaniasis patients are anorexic so that they will not take enough quantity of foods [33].

The main limitation of this study was a failure to diagnose asymptomatic diseases that had an association with underweight. However, since the patients and their comparator (family members) were drawn from the same community the distribution of asymptomatic cases are similar which minimizes the bias.

5. Conclusion

Kala-azar patients are highly affected by underweight and anemia. The nutritional status of visceral leishmaniasis patients was affected by intestinal parasites, sex, educational status, occupation, residence, and income.

6. Recommendation

Visceral leishmaniasis treatments guideline should consider nutritional supplementation including iron to kala-azar patients.

Conflict of interest

The author declares that there is no conflict of interest exists.

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